Wideband HF Antenna

User Manual

Revision	Description	Date
01	First issue	25/12/2011

INDEX

INDEX **2**
1. PURPOSE OF MANUAL **3**
2. REFERENCE SPECIFICATIONS **3**
3. ATTACHED DOCUMENTS **3**
4. SAFETY INSTRUCTIONS **4**
5. PRODUCT DESCRIPTION **5**
5.1. HIGHLIGHTS 5
5.2. MECHANICAL FEATURES 5
5.3. ELECTRICAL FEATURES 5
5.4. WORKING PRINCIPLE 6
5.5. PHYSICAL LAYOUT 6
5.6. RADIATION PATTERNS 7
6. INSTALLATION **9**
6.1. ROOF MOUNT MODEL 11
a. Mounting Using Extension Pole *12*
b. Direct Wall Mounting *13*
6.2. NAVAL MOUNT VERSION 14
6.3. ELECTRICAL CONNECTIONS 15

1. Purpose of Manual

This manual describes all the features and technical specifications for the wideband HF antenna, furthermore contains detailed information necessary for installation and operation.

Such manual is intended both to radio operators as well as service and maintenance technicians putting into service the antenna connected with other units (i.e.: hf SSB transceivers).

2. Reference Specifications

MIL-STD-461E	Requirements for the Control of Electromagnetic Interference Emissions and Susceptibility.
MIL-STD-810F	Department of Defense Test Method Standard for Environmental Engineering considerations and Laboratory

3. Attached documents

Model	Title
FAA5522B	Roof Mount Antenna
FAA5523B	Naval Mount Antenna

4. Safety Instructions

Warning
At no time during assembly, installation adjustment or operation should any part of this product be allowed to come into contact with electric power line. Nor should this product be installed in such a way that any part of it may contact power line during normal operation or in the event of structural failure. Failure to exercise extreme care in this matter can result in damage property, personal injury or even death.

Caution
Some parts of the equipment become very hot and will cause burns if accidentally touched.

Warning during installation
Antenna installation is very easy, make sure that all parts and hardware are present before beginnig the assembly and installation. Work in a clear area where dropped hardware may be easily recovered. Consult the parts pictorial page and parts list below.

5. Product Description

The Wideband HF antenna is a relative high efficiency broadband vertical radiator intended for use with frequency agile transmission systems over the 2 - 30 MHz HF band (i.e.: HF/ALE systems).
It is produced in two different versions, respectively FAA5522B for the roof mounting solution and FAA5523B for the naval mounting solution.

5.1. Highlights

- Minimal maintenance requirements
- High Reliability
- Broadband: a decade frequency interval typical
- No tuning devices
- SWR 1:1.5 typical on entire bandwidth
- 50 ohm coax feed line (a MIL quality RG-213/U is suggested)
- RF power 1.5 kilowatt P.E.P., 500 watt average
- Rugged fiberglass element and steel mounting for harsh environment

5.2. Mechanical Features

Length	10 meters
Weight	20 Kg
Sections	2
Bottom diameter	57 mm
Antenna structure	epoxy fiberglass
Finishing	Polyurethane paint
Colour	grey RAL 7030
Irradiation element material	high Q Teflon line
Ferrule material	inox steel per AISI 316
Working temperature	-35 °C to +80 °C
Max wind resistance	180 Km/h

5.3. Electrical Features

Frequency	2 to 30 MHz
Impedance	50 ohm
Polarization	Vertical
Horizontal radiation pattern	360 °
Vertical radiation pattern	See diagram
Connection to TX	50 Ohms coax cable (recommended RG-213/U)
Ground	Yes

5.4. Working Principle

The wideband HF is whip antenna intended for use with ALE capable transceivers for HF communication. Although no external tuning is necessary for operation over the 3 to 30 MHz band, an ATU (Antenna Tuner Unit) can be used to improve SWR ratio.

By the way, working principle is based on unique method of coupling transmission line transformers. A detailed analysis of the impedance adapter network revealed that it actually consists of two separate transformers with inter-coupled windings. This technique is used in conjunction with a single feedback winding on one of the transformers.

The overall result is a complex design that form a network, which improves the match at specific frequencies introducing, where necessary, an additional series impedance.

5.5. Physical layout

The basement of the 10 meter self-supporting whip is mounted on a U–shaped, special grade stainless steel, sturdy plate, see Fig. 9 and Fig. 11. The impedance adaptor, along with toroidal transformers, is mounted in a aluminum enclosure with integral heat sink, see Fig. 12.

5.6. Radiation Patterns

The typical vertical radiation patterns on several frequencies of the HF spectrum is provided in Fig. to .
In this case the antenna is mounted on a building roof.

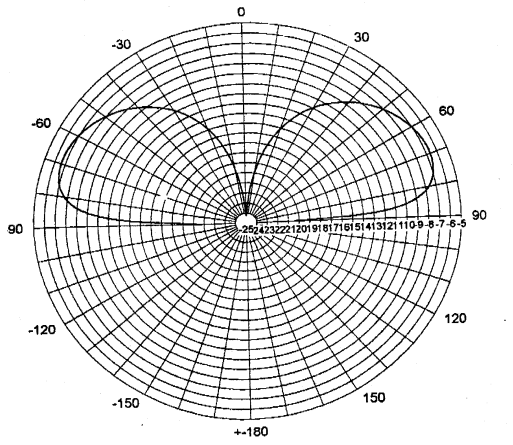

Fig. 1 - Pattern radiation F=3 MHz

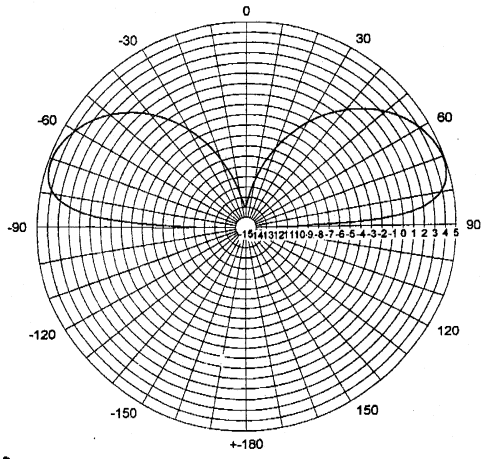

Fig. 2 - Pattern radiation F=7 MHz

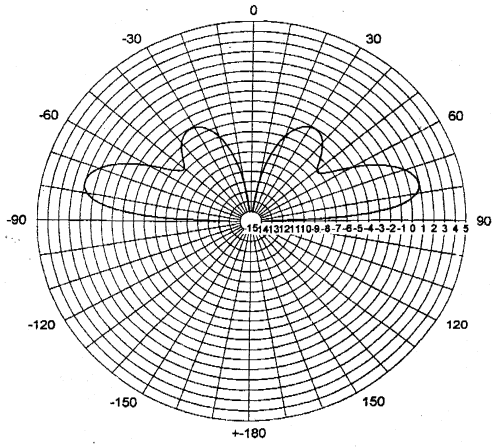

Fig. 3 - Pattern radiation F=14 MHz

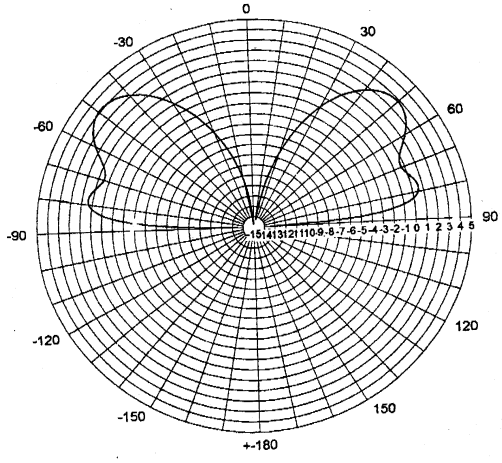

Fig. 4 - Pattern radiation F=20 MHz

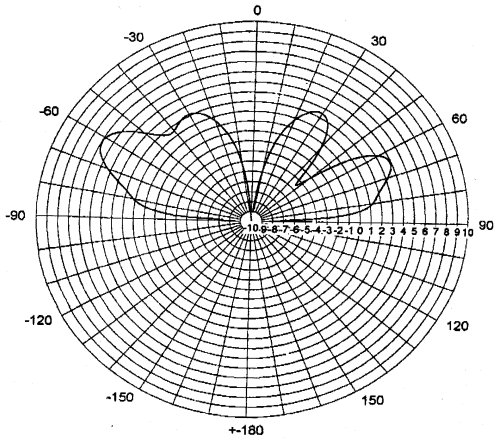

Fig. 5 - Pattern radiation F=26 MHz

6. Installation

As with all antennas, great care should be exercised in the choice of a site for the Wideband HF antenna, pattern radiation as well as operating bandwidth and SWR can be greatly influenced by the antenna' proximity to the earth and other conductors.

The ideal mounting for the Wideband HF antenna is 6 to 10ft (2-3m) above ground, as far away as possible from reflecting metal objects. A flat roof on a concrete building is also good. This guarantees low radiation angles. Mounting too close to a house (30ft or less) is less recommended.
This results in an inferior radiation pattern and, more importantly, a heavily increased noise level from house installations, power lines, etc..
Mounting on a mast or tower higher than 10ft results in high radiation pattern (up to 60 degrees).
As with all good antennas, the Wideband HF antenna acts to nearby objects such as other antennas, lightning protection systems, wires, etc..
This is particularly pronounced with items that are closer than one wavelength and longer than 1/2 wavelength at the working frequencies. Under these circumstances, the antenna can receive its own signal back, resulting in increased SWR.
Thanks to its design the antenna is electrically connected to ground, that's for safety and low static noise. The base mount needs to be well grounded.
The diagram below represents a real SWR performance relative to a typical installation on a building roof, the average return loss value is more than 15 dB or 1:1,4 in terms of VSWR.

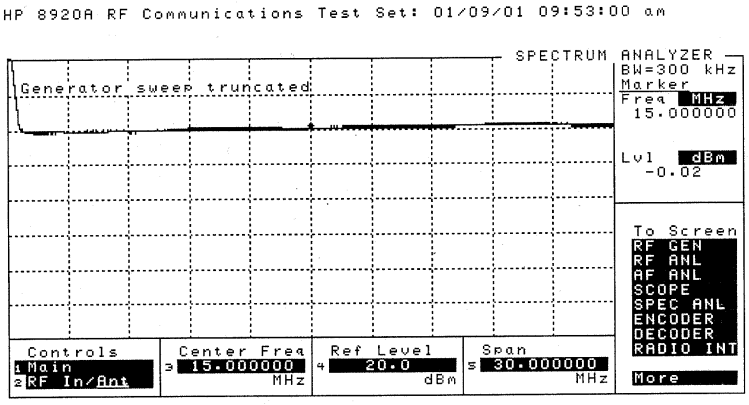

Figura 6 - Tipical SWR performance (Reference level = 0dB)

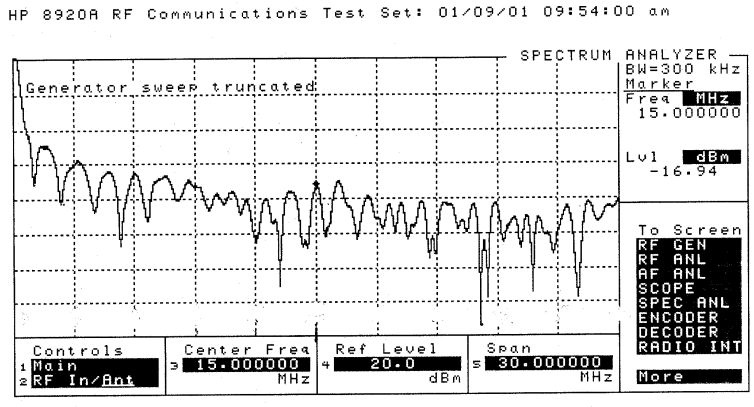

Figura 7 - Typical SWR Performance (Measure level = 20dB return loss average)

6.1. Whip assembly

All models of antennas are delivered with the Whip divided in 2 sections. The first operation to be done at installation is to assemble the 2 sections by means of suitable threaded joints.

6.2. Roof Mount Model

The FAA5522B, is the roof mounting model, it is provided of a suitable stainless steel brackets which allows the installation through an extension pole or mast.
This method is always the best if the supporting pole (diameter 58.5mm ±5%, not supplied) is height enough to guarantee an average height of the antenna of not less of 6 to 10ft (2-3m) above surroundings buildings.
Optionally the antenna can be mounted directly to the wall using an opportune adapter bracket (not supplied).
The contents of the delivered package is shown below.

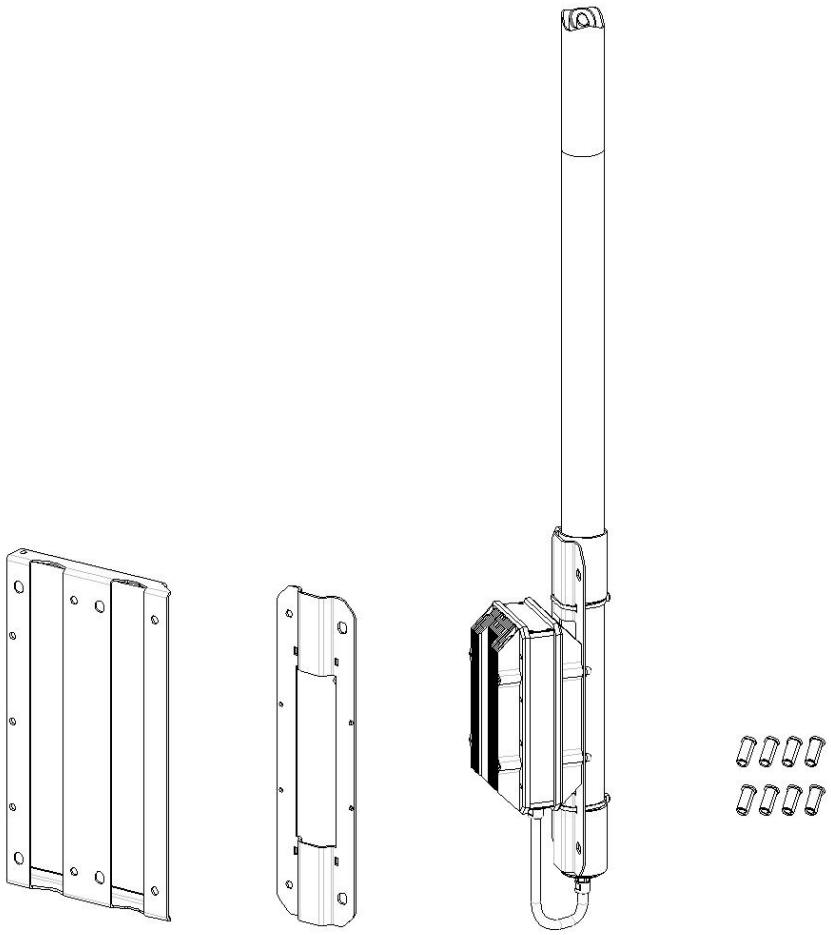

Fig. 8 – FAA5522B parts included in the delivery package

The package is comprehensive of the following parts.

1. Horizontal Bracket type A
2. # 2 Whip Bracket type B (one is supplied already fitted to the Whip and Tuning Unit)
3. Two section (5 meters lenght) of Fiberglass Whip whit Tuning Adaptor box
4. # 8 Special Nuts
5. # 8 M10x30 screws
6. # 8 M10 lock washers

a. Mounting Using Extension Pole

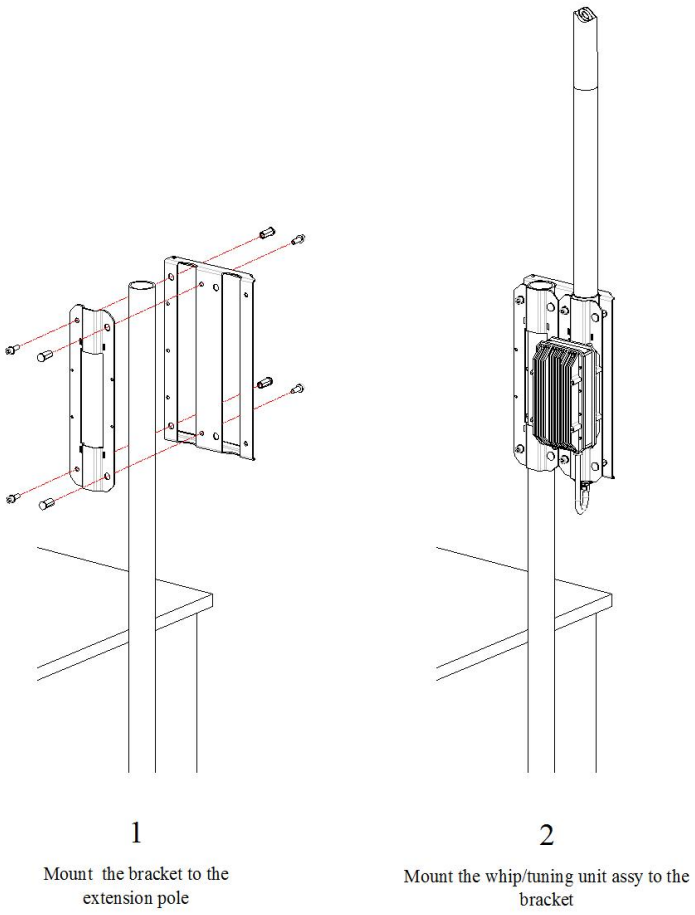

Fig. 9 - Mounting using Extension Pole

You must follow, step-by-step, the procedure described below.

1. Check presence of extension pole (not supplied) installed as required in paragraph 6.1.
2. Install as shown in step 1 of Fig. 10 the Horizontal Bracket on top of the pole by means of 4 Special Nuts and 4 screws.
3. Assure as shown in step 2 the of Fig. 10 Whip/Tuning adaptor using the supplied hardware (as shown in the precedent step).

b. Direct Wall Mounting

By means of a suitable Wall bracket (not supplied, orderable with P/N FAA5522B), you can install the antenna directly on the wall.

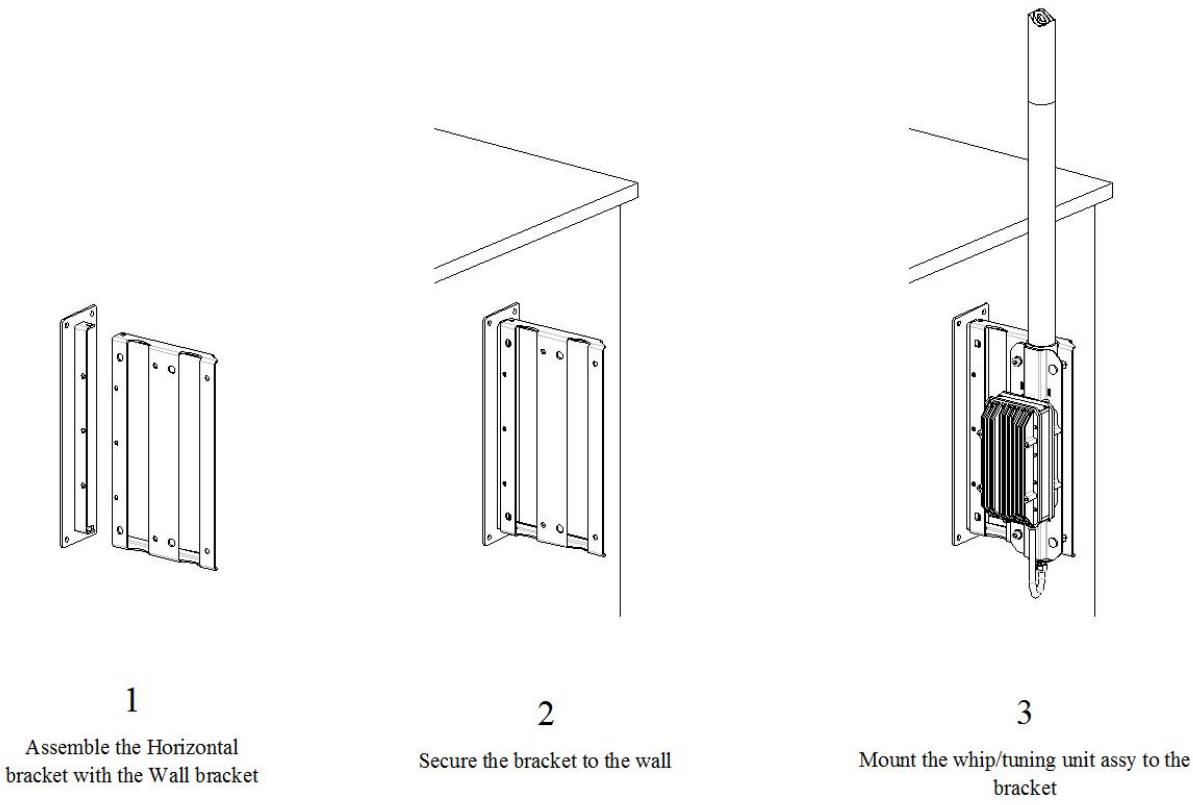
1
Assemble the Horizontal bracket with the Wall bracket
2
Secure the bracket to the wall
3
Mount the whip/tuning unit assy to the bracket

Fig. 10 - Direct Wall Mounting

You must follow, step-by-step, the procedure described below.

1. As shown in the figure above, it is necessary to assemble the Horizontal bracket with the Wall bracket (not supplied)
2. Secure the Wall Bracket to the wall in the most appropriate way.
3. After step 2. you need to assure the whip/tuning adaptor assembly to the Wall Bracket by #4 Special Nuts.

6.3. Naval Mount Version

The FAA5523B model is the marine version of the wideband antenna and is fully assembled with a special mounting basement suitable for ship deck floor installation.
Because of its design, mechanical installation is very easy, therefore is sufficient to secure the antenna basement to the ship deck floor previously prepared.

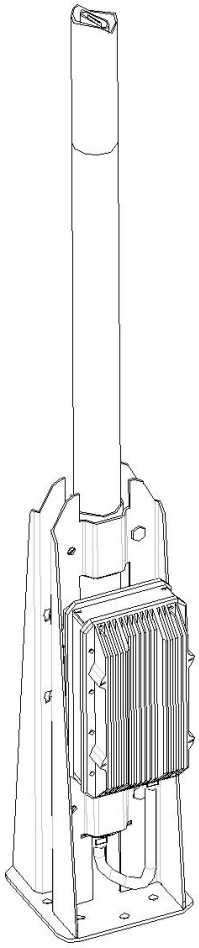

Figura 10 - Naval Mounting model

6.4. Electrical connections

The antenna electrical connections are located at the bottom of the Tuning Unit as shown in the figure below.

The feeding input is the N connector (female)
The ground connection is represented by the M6 screw with wing nut and lock washer.

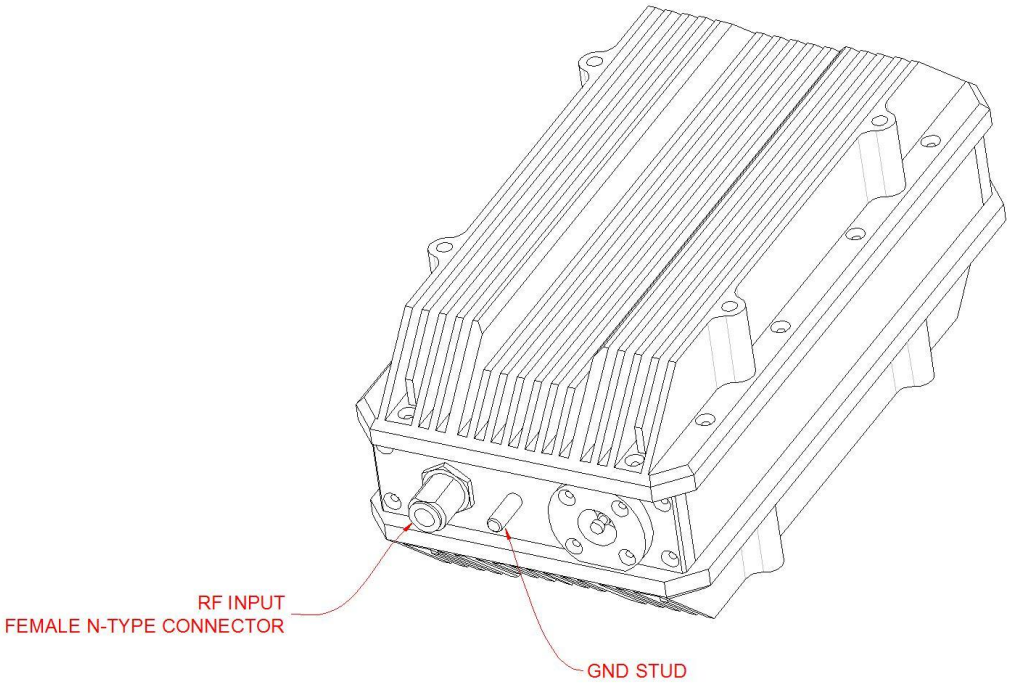

Figure 11 - Electrical Connections